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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/764,486	01/27/2004	Tokuharu Kimura	040024	6268

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EXAMINER

HU, SHOUXIANG

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 10/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/764,486

Applicant(s)

KIMURA ET AL.

Examiner

Shouxiang Hu

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 August 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) 4-6,8,10-15,18,19,21 and 22 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3,7,9,16,17 and 20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Claims 4-6, 8 and 10-15 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in Paper dated 01-27-2005.
2. In addition, claims 18-19 and 21-22 are also withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being unreadable on the elected Species 1 of Figs. 1a-1d.

Accordingly, claims 1-22 are pending in this application; and claims 1-3, 7, 9, 16-17 and 20 remain active in this office action.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-3, 7, 9, 16-17 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Inoue (Inoue et al., JP 2001-230407; of record) in view of applicant's admitted prior art ("AAPA"), Sheppard (Sheppard et al., US 6,316,793) and/or Dawson (Dawson et al. (US 6,399,493).

Inoue discloses a compound semiconductor device (Fig. 1A; see US 6,639,255 for its English translation), comprising: a substrate (101 and 102); a channel layer (103; GaN); an electron supply layer (104; n-type AlGaIn); a cap layer (105; GaN); a gate electrode (107) disposed on the surface of the cap layer and forming a Schottky contact; recesses formed on the source/drain sides; and, source/drain electrodes 106 and 108).

Although Inoue does not expressly disclose that the cap layer can also be n-type and that the bottom surfaces of the recesses can be roughened compared to the top surface of the cap layer, one of ordinary skill in the art would readily recognize that the cap layer can be also be desirably n-type doped for providing more electrons to the channel region, as evidenced in AAPA (see the n-type cap layer 8 in Fig. 8C; also see JP 2002-359256, which has an application number of JP 2001-164906, in view of the remarks made in the 08-02-2005 Amendment); and that It is always desirable to form silicided contact to the source/drain region, as evidenced in Sheppard (see the silicided source/drain contacts 20 and 21 in the cover page figure), and such silicided contact can be better formed by roughening the source/drain contact surfaces, as evidenced in Dawson (see the roughened region 42 in the cover page figure).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the n-type cap of into the semiconductor device of Inoue with the source/drain contact surfaces being substantially roughened, per the teachings of Sheppard and Dawson (Dawson et al. (US 6,399,493), so that a device with more electrons for the channel region and with better silicided contact to the

source and drain regions would be obtained. And, the substantially roughened surfaces would be naturally rougher than the un-roughened surface of the cap layer in the above collectively taught device.

Regarding claim 2, it is noted that the roughness of the roughened source/drain surfaces is an art-recognized parameter of importance subject to routine experimentation and optimization.

Regarding claims 3 and 20, it is art-known that a very thin insulating passivation film can be desirably formed to cover the upper surfaces of the device, so as to enhance the electrical isolation between the surface electrodes, as readily evidenced in the prior art such as Martinez et al., US 6,528,405 (see the thin passivation film 71 in the cover page figure).

Regarding claims 16-17, it is art-known that it is not necessary to remove the entire cap layer in the source/drain regions, so that the process conditions can be desirably relaxed, as readily evidenced in the prior art such as Nakayama et al., US 6,492,669 (see the cap layer 6 in Fig. 10).

Response to Arguments

5. Applicant's arguments made in the August-02-2005 amendment have been fully considered but they are not persuasive, as explained below.

First, regarding Fig. 8c in the instant disclosure, what admitted in applicant's remarks (see pages 8 and 9 in the above amendment) further confirms that what is shown in Fig. 8c is indeed a valid 102(b)-type prior art, as it was already

disclosed/published on December 13, 2002, which is more than one year prior to the US application date (January 27, 2004) of the instant application.

Second, Sheppard does teach forming silicide electrodes, as Sheppard teaches forming the electrodes (20 and 21) with an alloy of silicon and metal(s). And, it is art-known that such an alloy is naturally a silicide.

Third, in response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). And, in response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Sheppard is cited to show that one of ordinary skill in the art commonly recognize the desirability of forming silicide contacts to the source/drain regions. And, Dawson is cited to show that the ordinary skill also readily recognize that the source/drain silicide contacts can be better formed by roughening the source/drain surfaces. Accordingly, it would be well within the ordinary skill in the art to make the device of Inoue, with the source/drain surfaces therein being roughened in order to form silicide source/drain

electrodes thereon, per the teachings of Dawsan and Sheppard, so as to formed better electrical contact to the source/drain regions, among other improvements.

Fourth, responses to applicant's other arguments/amendments have been incorporated into the claim rejections set forth above in this office action.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. References A-B and N are cited as being related to a GaN-based HEMT structure.

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is 571-272-

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1654. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SH
October 6, 2005


SHOUXIANG HU
PRIMARY EXAMINER